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NESTING SUCCESS AND MORTALITY OF NESTLINGS IN A COASTAL ALABAMA HERON - EGRET COLONY, 1976

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ABSTRACT: A heronry at Cat Island, Alabama was surveyed throughout the 1976 breeding season to determine colony structure and survivability of young Ardeidae during varying weather conditions. A total of 155 nests were tagged and the clutch of each monitored until the nestlings abandoned the nests. Offspring of herons nesting during unfavorable weather conditions of late Spring suffered significantly higher mortality than birds nesting in mid-summer. Species nesting on Cat Island include the Louisiana Heron, Snowy Egret, Great Egret, Cattle Egret, Little Blue Heron, Green Heron, and Glossy Ibis.

The Cat Island colony supports the largest assemblage of nesting Louisiana Herons (*Hydranassa tricolor*) in Alabama, (Dusi, 1967), and includes a variety of other nesting species: Snowy Egret (*Leucophoyx thula*), Great Egret (*Casmerodius albus*), Cattle Egret (*Bubulcus ibis*), Little Blue Heron (*Florida caerulea*), Green Heron (*Butorides virescens*), and Glossy Ibis (*Plegadis falcinellus*).

The main purpose of this study was to determine colony structure, and nesting success of the many ardeid speices (Family Ardeidae) present on Cat Island during the 1976 breeding season. Previous surveys of Heron-Egret colonies include: Meanley (1955) in Arkansas, Bowen (1962) in southern Ghana, Dusi (1963 - 1970) in Alabama, Jenni (1969) in central Florida, and Shanholtzer (1972) in southern Florida and coastal Georgia.

Information on the influence of weather on nesting wading birds is scarce in the literature. Dusi and Dusi (1968) reported a total failure during periods of drought in a Cattle Egret heronry in Houston County, Alabama. Jenni (1969) attributed the death of numerous young birds in a Florida heronry to heavy wind and rain. In order to evaluate the effect of seasonally variable climatic conditions on nesting success, meterological data were collected in conjunction with the nesting survey during the present study.

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Cat Island is a rectangular-shaped marsh island located approximately 11 kilometers north of Dauphin Island, Alabama (Fig. 1). Its 5.2 hectares include 51% (2.63 hectare) tidally innundated salt marsh, 31% (1.62 hectare)

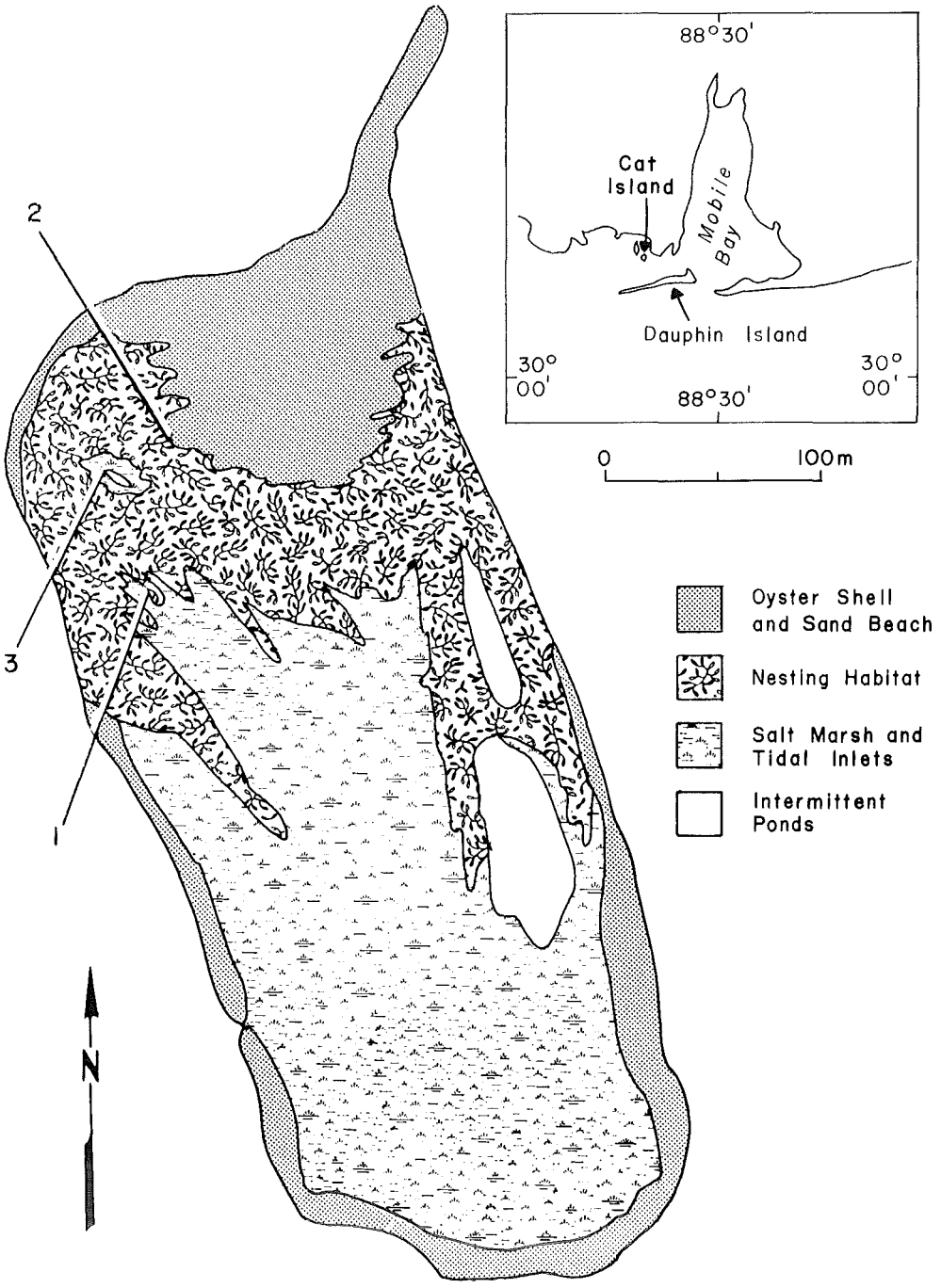

Fig. 1 Cat Island, Alabama. Map of Island showing habitat types and location of Study Areas (1-3 numbered at left) utilized during the 1976 Nesting Survey.

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beach and shell deposits, and 18% (0.93 hectare) nesting habitat.

The salt marsh component is primarily a network of tidal inlets which isolate patches of smooth cordgrass (*Spartina alterniflora*). The north end of the island is densely populated with marsh elder (*Iva frutescens*), groundsel tree (*Baccharis halimifolia*), and cactus (*Opuntia compressa*). Marsh elder, which grows to a maximum height of 2-3 meters comprises nearly all of the nesting habitat for the Ciconiiformes and Glossy Ibis.

Certain portions of the heronry were totally inaccessable due to the density of the marsh elder and cactus. Since this made censusing of the entire population at Cat Island difficult, three sites were selected as study areas. Observations of the nesting habitat indicated that three sites were representative of the overall heronry.

A number of factors combine in making Cat Island an ideal location for an heron-egret colony. Because it is surrounded by shallow water and oyster shoals, it is isolated from most human intrusion, and protected from predation by domestic animals. Tidal inlets and open salt marsh provide a ready food source for the varied diets of the nesting birds. The vegetation of the island, though optimal for herons and egrets, lacks pine trees, and is thus quite unsuitable for nesting by predaceous fish crows, which often pillage heronries near their nests. A number of predaceous bird species have been identified during egret colony studies, including the fish crow (*Corvus ossifragus*), blue jay (*Cyanocitta cristata*), and barred owl (*Strix varia*) (Dusi, 1968). Both the fish crow and blue jay were observed to frequent Cat Island. A Barn Owl *Tyto alba (practincola)?* was found to roost in a nearby marsh.

This study was initiated in April, 1976 as the result of three months of observation during the 1975 nesting period. To distinguish nests in the study area, each nest observed was marked with a survey ribbon and designated by a numbered tag. Nests were tagged during incubation of eggs, and observed until the young birds fledged the nests. Initially 100 nests were identified for observation. When all of these nests were empty, an addtional 55 nests were tagged. Thus the study was divided into Periods A and B, which represented separate time frames. Study A began in April, and B in June. (Table 1.)

Three specific areas of the island were selected for tagging nests (Fig. 1). Areas 1 and 2 were included in Study A, and Area 3 was utilized in Study B. Together these areas represented the various nesting habitats of Cat Island. Area 1 was a series of marsh pathways between rows of marsh elder, Area 2 a combination of groundsel tree and marsh elder on the perimeter of the nesting habitat. Area 3 combined marsh pathways, thick marsh elder, and nesting habitat surrounding an intermittent freshwater pond.

Throughout the study observations were made during late morning and midday hours. When rain or unfavorable weather existed, the survey was post-

Table 1. Dates of survey weeks for Study Periods A and B of Fig. 1 Cat Island, AL 1976

Study Period	
A	B
Survey Week	Survey Week
1. 4/21 - 4/28	1. 6/16 - 6/23
2. 4/29 - 5/5	2. 6/24 - 7/2
3. 5/6 - 5/12	3. 7/3 - 7/7
4. 5/13 - 5/19	4. 7/8 - 7/14
5. 5/20 - 5/26	5. 7/15 - 7/21
6. 5/27 - 6/3	6. 7/22 - 7/28

poned a day, thus incubation was not disturbed during conditions that may have jeopardized the survival of the eggs and young birds.

Measurements were made on the nests and eggs studied. Vernier calipers were used to measure egg dimensions of Louisiana Herons, and average nest height for 250 nests was determined using a meter stick. Quadrats were established within each of the three study areas to estimate the number of nests per area and determine habitat preference.

Due to the uncertainty in distinquishing between the young of the Little Blue Heron and the Snowy Egret, only nesting survey data for the Louisiana Heron and Cattle Egret will be included in the discussion. Information presented in Table 2 and 5, however, represents data compiled for all four young Heron species mentioned above.

Categories of development were designated for young birds in order to distinguish their growth stages. Newly hatched birds were identified as "Hatchlings" (Table 2). Herons and egrets are altricial, or helpless, for the first few days of their lives, and are unable to feed or defend themselves. After 7-10 days the birds grew stronger, propping their wings on the nests and striking at intruders. At this time the birds periodically left their nests to climb about in the marsh elder, but returned to the nest for feeding. These birds were called "fledglings", though they were not able to fly. By the time the birds could fly they had completely abandoned their nests and were listed in Table 2 as "out of nest".

The relative abundance of species present was determined using both aerial and ground-level photography.

Daily climatic data (minimum temperature, maximum wind velocity, and rainfall) were collected from the Dauphin Island meterological station during the survey weeks of each study period. This information, along with weekly mortality data, is presented in Fig. 2.

RESULTS AND DISCUSSION

The first reported survey of the Cat Island heronry occured in 1965 when Dr. Willson Gaillard observed Cattle Egrets, Snowy Egrets, Louisiana Herons, and Reddish Egrets nesting (Dusi, 1967). Reddish Egrets did not nest on Cat Island during the present study; however, a total of 2,200 to 3,300 nests of other species were constructed in the 0.93 hectare of nesting habitat.

All nests observed were built in marsh elder and groundsel tree. No preference of vegetation type for nesting was observed for any of the species studied. Louisiana Herons average nest height was 1.0 m, and Cattle Egrets averaged 1.2 m. Nest height throughout the country seems to be a reflection of the habitat height chosen (Table 3).

Egg dimensions for Louisiana Herons nesting at Cat Island averaged 43.2 x 32.5 mm for 221 eggs. The extremes ranged from 48.9 x 35.4 mm to 40.5 x 32.0 mm. These figures are comparable to measurements provided by Bent (1926) for Louisiana Herons.

Louisiana Herons in Period A had an average clutch of 2.7 eggs (90 nests), while during study period B their average clutch was 2.4 eggs (8 nests). Cattle Egrets, which nested only during the latter study period had an average clutch size of 2.3 eggs (47 nests). Most nests in a similar heronry of mixed species near Gainesville, Florida contained 3 to 4 eggs (Jenni, 1969): Louisiana Herons averaged 4.1 eggs, Snowy Egrets 3.9, Cattle Egrets 3.5, and Little Blue Herons 3.7 eggs. Howell (1932) reported the

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clutch as 3 to 5 for Louisiana Herons in other parts of Florida. Louisiana Herons in Georgia reportedly average 3.1 eggs (Teal, 1965). Cattle Egrets averaged 3.6 eggs in Maryland (Valentine, 1958), 3.3 eggs in South Carolina (Cutts, 1958), and 2.6 eggs in southern Ghana (Bowen et. al., 1962). Lack (1954) noted that average clutch size of many birds increases with increased distance from the equator, yet there seems to be no evidence for such an observation in herons. Rather, Dusi and Dusi (1970) have shown that clutch size may vary according to weather conditions.

Their data showed that during periods of drought in Houston County, Alabama the clutch size of Cattle Egrets measured only 2.4 eggs. Jenni (1969) also found clutch size of Cattle Egrets to be much lower than Louisiana Herons, but attributed the difference to adaptation of the Cattle Egret to food availability.

Reduction in clutch size exhibited by the Louisiana Herons, from 2.7 eggs in Period A to 2.4 in Period B, may be attributed to renesting. Louisiana Herons often renest when they fail to produce fledgings in their first clutch (Audubon, 1967). Jenni (1969) noted that heron species with long nesting seasons had late clutches that were smaller than their earlier clutches.

Study Period A included 6 weeks of surveys on 100 tagged nests, containing 266 eggs, in Study Areas 1 and 2 (Fig. 1) during late April (Table 1). At this time Louisiana Herons occupied over 90% of the nests surveyed. The remaining ten nests were represented by Snowy Egrets and Little Blue Herons, Cattle Egrets having not yet begun to nest. Total nest density for the two Study Areas was estimated at 32 nests per 100 m^2.

By the second week of Period A numerous hatchlings were found dead in their nests (Table 2). Nesting success of this period was low as a result of an 81.9% mortality. Seventy-one per cent mortality occurred among hatchlings and fledglings, many of which appeared diseased. Only 29% of the toal mortality of Period A resulted from egg loss.

Similar studies of heronries in Alabama showed that Little Blue Herons suffered mortality of only 10-25% during their first 2-5 weeks, but would total 74% during the first year after fledging (Dusi, 1963). Predators and poor nests limited survival to 14.5% for Cattle Egrets in a heronry near Dothan, Alabama (Dusi and Dusi, 1970). Over-all mortality in a Florida heronry from the time of laying, through two weeks of observation are 42.5% in Snowy Egrets, 37.7% for Little Blue Herons, 35.8% for Louisiana Herons, but only 17.9% for Cattle Egrets (Jenni, 1969). Additional survey mortality figures are provided in Table 4.

Study Period B began June 16, and covered the last half of the nesting season at Cat Island (Table 1). Study Area 3 was utilized during this period, since habitat types similar to Area 1 and 2 occurred there (Fig. 1). It was during this time that Cattle Egrets replaced Louisiana Herons as the most numerous nesting species.

Dusi (1968) studied Little Blue Herons in Houston County, Alabama, noting that when the Cattle Egrets arrived at the heronry for courtship the Little Blue Herons, which shared the breeding habitat, were already incubating. Similar studies enforced this observation (Jenni, 1969; Dusi and Dusi, 1970; and Shanholtzer, 1972). Cattle Egret at Cat Island followed the same pattern in the 1975 and 1976 breeding seasons, arriving after many of the other heron young had fledged. Since most Louisiana Herons had already left the nesting areas during the latter half of the Cat Island breeding season, the Cattle Egrets composed 90%

Table 2. Weekly succession of development from eggs produced to subsequent fledging from nests by young herons at Cat Island, Alabama. Distribution for three categories of mortality are also provided for Study Periods A and B.

	Weekly Survey No.					
Study Period A	1	2	3	4	5	6
Eggs	220	94	21	3	0	0
Hatchlings	30	122	106	14	0	0
Fledglings	0	12	32	37	6	0
Out of Nest	0	0	1	26	16	5
Dead Fledglings	0	0	0	23	21	1
Dead Hatchlings	0	6	46	45	11	0
Eggs Lost	16	16	22	9	0	0
Study Period B						
Eggs	76	51	31	5	0	0
Hatchlings	28	17	26	5	0	0
Fledglings	19	39	20	24	31	0
Out of Nest	0	11	28	14	17	31
Dead Fledglings	0	0	1	0	1	0
Dead Hatchlings	0	2	0	2	0	0
Eggs Lost	6	3	1	7	5	0

of all nests surveyed in Period B.

Mortality of those birds nesting during Period B totaled only 22% from egg to fledgling, much lower than the 81.9% mentioned previously for Period A. As seen in Table 2 most of the birds lost during Period B were eggs that either failed to hatch or were taken by predators. Very few hatchlings or fledglings died, and none exhibited any sign of disease. Jenni (1969) found similar results and attributed the success to the adult Cattle Egrets which were more attentive to the eggs and nestlings than other herons.

Although Cattle Egrets at Cat Island had a much higher nesting success than Louisiana Herons, studies in other heronries have shown that Cattle Egret success is highly variable (Table 4), and they may have total nesting failure during some breeding seasons (Dusi and Dusi, 1968). These failures have been attributed to droughts which limited available food.

Unfavorable weather conditons also are apparently responsible for the high mortality of Period A. Table 5 indicates the percentage of mortality during each week of the overall survey. Figure 2 shows the relation between weekly mortality and several weather parameters during the study periods.

Wind gusts in excess of 30 knots

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Table 3. Nest height and preferred nesting habitat of herons in various study areas.

Location	Species
Cat Island, Alabama (Present Study)	Cattle Egret
Cat Island, Alabama (Present Study)	Louisiana Heron
Alachua Co., Florida (Jenni, 1969)	Louisiana Heron
Snake Key, Florida (Jenni, 1969)	Snowy Egret
Texas (Bent, 1926)	Louisiana Heron
Eastern Arkansas (Meanley, 1955)	Little Blue Heron
Everglades Nat'l. Park, Florida (Shanholtzer, 1972)	Multiple species
Emanuel Co., Georgia (Shanholtzer, 1972)	Multiple species
Ossabaw Island, Georgia (Shanholtzer, 1972)	Multiple species
Florida (Howell, 1932)	Louisiana Heron
North Carolina (Funderburg, 1960)	Louisiana Heron
North Carolina (Funderburg, 1960)	Cattle Egret
Missouri (Peterson, 1965)	Cattle Egret
Texas (Bent, 1926)	Cattle Egret
Nevada (Giles and Marshall, 1954)	Cattle Egret
Vegetation	**Nest Height**
Marsh elder, and Groundsel tree	1.2 m
Marsh elder, and Groundsel tree	1.0 m
Myrtle	1.74 m
Mangroves	2.4 - 3.7 m
N. R.	0.3 - 0.6 m
Catalpa woods	2.7 - 5.5 m
Willow, and Pond Apple	1.0 - 2.5 m
Buttonbush, and Tupelo	1.0 - 4.0 m
Willow, Bayberry, and Cabbage Palmetto	0.2 - 2.5 m
Willows, Mangroves, Buttonwoods, and Rushes	N.R.
Red Cedar, and Wax Myrtle	N.R.
Red Cedar	N.R.
Pines	N.R.
Prickley pear	N.R.
Hard-stem Bullrush	N.R.

N.R. = No Record.

occurred periodically throughout the Period A survey. Such winds contribute to the high egg loss shown in Table 2. Many of the eggs destroyed fell from poorly constructed nests.

During week 4 of the Period A survey (Fig. 2) rainfall in an excess of 7.5 cm was succeeded by a temperature decline to 15°C. Nearly 50% of the nestlings died by the end of this week (Table 5). Those that survived were noticeably weakened, and appeared diseased. Few of these survived the high winds and additional rainfall of survey week 5. Jenni (1969) also attributed numerous young heron deaths to rainfall following 3.55 inches (9.0 cm) of rain in a Florida heronry. Additional mortality resulted from heavy wind during his 1960 survey.

By the beginning of Study Period B

Table 4. Mortality of eggs and nestlings of four herons in various study areas.

Location	Species	Mortality
Cat Island, Al. 1976	Louisiana Heron	81.9%
Cat Island, Al. 1976	Cattle Egret	22.0%
Dothan, Al. (Dusi and Dusi, 1970)	Cattle Egret	85.5%
Gainesville, Fl. (Jenni, 1969)	Snowy Egret	42.5%
	Little Blue Heron	37.7%
	Louisiana Heron	35.8%
	Cattle Egret	17.9%
Sapelo Island, Ga. (Teal, 1965)	Louisiana Heron	19.0% eggs 57.0% nestlings
Alabama (Dusi, 1963)	Little Blue Heron	10-25%
Ghana (Bowen et. al., 1962)	Cattle Egret	71%
Arkansas (Meanley, 1955)	Little Blue Heron	18-25%

Cattle Egrets had begun incubating. During the 6 weeks of their nesting period there were no wind gusts above 25 knots, no daily temperatures below 20°C, and the only significant precipitation occurred during week one (Fig. 2). Since rainfall was not accompanied by high winds the adult birds probably were able to protect the eggs.

A four week drought began on July 1. Such conditions prior to nesting have been shown to upset the physiological processes of Cattle Egrets (Dusi and Dusi, 1968). Once these egrets began incubating, however, droughts apparently had no adverse effect on survival of the hatchlings, and 78% of the young observed in Period B survived.

The total survival of young Cattle Egrets in Period B actually exceeded 78%, for nearly all of those lost (79%) were eggs (Table 2). All 8 Louisiana Heron nests surveyed during this period produced fledglings.

CONCLUSIONS

Nest height for all species at Cat

Table 5. Percentage of mortality for each survey week of Periods A and B. Cat Island, Alabama, 1976.

	Weekly Survey No.					
Study Period A	1	2	3	4	5	6
Live	259	257	228	159	54	6
Dead	16	22	68	77	32	1
% Mortality	6.2	8.6	29.8	48.4	59.3	16.7
Study Period B						
Live	129	123	107	77	34	31
Dead	6	5	2	9	6	0
% Mortality	4.6	4.1	1.9	11.7	17.6	0

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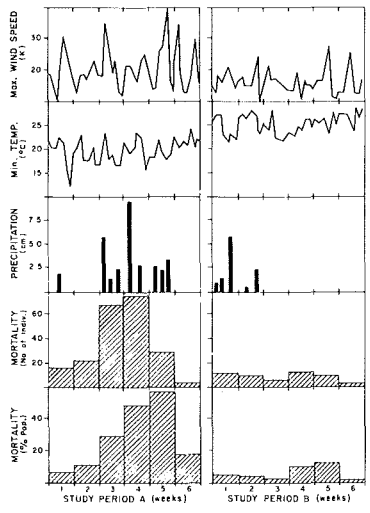

Fig. 2 A comparison of weather parameters that existed during the survey weeks of each Study Period (Top) and weekly mortality by percentage of population and number of individuals (bottom). Cat Island, Alabama 1976.

Island averaged 1.1 m, which was somewhat lower than nest height in some other coastal heronries.

Clutch size for Louisiana Herons averaged 2.7, but dropped to 2.4 later during the study. This reduction in clutch size was attributed to nesting by birds that had failed to produce fledglings earlier in the breeding season. Cattle Egret clutch size was only 2.3 eggs; however, they produced more fledglings per nest than Louisiana Herons by nesting later in the breeding season.

Nesting success during the first period of study was only 18.1% as a result of adverse weather conditions (low temperatures, strong winds, and heavy rainfall). When Cattle Egrets became the dominant nester in later months weather conditions were more favorable for brooding young, despite a drought. The delayed nesting exhibited by Cattle Egrets in response to availability of food resources and ideal climatic conditions appears to be a decisive advantage in their nesting success observed at Cat Island.

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